Lessons From the Lunchroom

Childhood Obesity, School Lunch, and the Way to a Healthier Future
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Technical Appendix

Union of Concerned Scientists

Dataset

The Union of Concerned Scientists (UCS) used the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K) panel dataset, which has also been used in previous studies (Datar and Nicosia 2012; Van Hook and Altman 2012) to examine the impact of school foods on children's body mass index. ECLS-K was administered by the National Center for Education Statistics at the U.S. Department of Education and followed a nationally representative cohort of children from kindergarten through eighth grade. Data on children's demographics, diet, physical activity, height and weight (directly measured by study staff), and educational experiences were collected from children, parents, teachers, and school administrators.

We utilized data from the fifth- and eighth-grade surveys, as these were years when school administrators were asked about students' access to vending machines. Surveys were administered in 2004 and 2007, respectively. We eliminated from the study's final sample those students who had missing values for included variables in either fifth or eighth grade. Institutional review board (IRB) approval was not required for this study because the version of the ECLS-K dataset that we utilized was publicly available and does not reveal confidential information that could identify a particular child.

Data Analysis

UCS researchers analyzed the impact of changes in school vending machines on children's body mass index (BMI). Equation (1) specifies how changes in the availability of vending machines impact BMI for individual i (the student) at time t (school year):

$$y_{it} = \alpha_i + x_{it}\beta + z_{it}\beta + \varepsilon_{it}$$

Here, y denotes BMI, x denotes vending machine access, z denotes the independent variables, α denotes a time-invariant individual-specific effect (such as a student's gender or race/ethnicity), and ε denotes the error term. The error term includes unobserved individual-specific effects (effects that we cannot measure, but know to exist, such as a student's taste preferences or health beliefs) that affect y.

To remove individual-specific effects in the error term, we subtracted the error term in fifth grade (*t-1*) from the error term in eighth grade (*t*). This caused the time-invariant unobserved individual-specific effects to drop out. This first-differenced equation is presented in equation (2). Estimating this equation controls for the possibility that unobserved individual-specific effects may be included in the error term.

(2) $y_{it} - y_{i,t-1} = (x_{it} - x_{i,t-1})\beta + \varepsilon_{it} - \varepsilon_{i,t-1}$

The first-differenced equation (2) can also be seen as equation (3), that is, the change in BMI for individual *i* from fifth and eighth grade that was a directly affected by a change in vending machine availability:

(3) $\Delta y_i = \Delta\beta(x_i) + \Delta\delta(z_i) + \Delta\varepsilon_i$

We estimated equation (3) for all male students, all female students, all low-income students, and six subgroups each for white, African-American, and Hispanic children: (1) all male and female children, (2) all males, (3) all females, (4) males and females from low-income families, (5) males from low-income families, and (6) females from low-income families. We classified children as being from low-income families if their family income was below 185% of the federal poverty guidelines in both fifth and eighth grades.

Since the prevalence of vending machines is more common in a middle schools or combined schools (schools with students from kindergarten through eighth grade), we had to test for endogeniety. An endogenous variable is one or more variables being correlated with the error term, which is correlated with BMI. To test for endogeneity, we used an instrumental variable approach to assess whether the change in vending machine availability was due to an endogenous variable (a variable correlated with our error term). The general premise for using an instrumental variable approach is that in order to determine whether a variable is endogenous, we have to select a variable that is correlated with the endogenous variable and uncorrelated with the error term (the "instrument").

The instrument we used was an indicator variable representing whether (1) a child switched from an elementary school to a middle school or combined school between the fifth and eighth grade, and (2) a child's school's lowest grade in when he or she was in the eighth grade was between sixth and eighth grades. This instrument has used been in similar studies (Datar and Nicosia 2012; Van Hook and Altman 2012).

We used robust standard errors to control for heteroskedasticity, and we report statistical significance at 1%, 5%, and 10% thresholds. This data analysis was conducted in Stata (version 13, StataCorp, College Station, TX).

Measures

The dependent variable is the change in children's BMI between fifth and eighth grade. The independent variable of interest is the change in vending machine availability between fifth and eighth grade, and this is represented by a binary variable indicating a change in whether students could purchase food or beverages at vending machines in their school or not.

UCS researchers controlled for child-, household-, and school-level characteristics. Child-level characteristics included changes in the number of times per week the child ate breakfast with his or her family, ate dinner with his or her family, and exercised for 20 consecutive minutes; the number of hours per week the child watched television; and whether the child had a disability. We also included a constant since BMI changes between fifth and eighth grade could be attributable to changes in physiology from aging or other time-varying unobserved external influences.

Household-level characteristics included changes in the number of individuals living in the household; whether the child lived with non-biological parents, a single mother, or a single father; whether the family received Supplemental Nutrition Assistance Program (SNAP) benefits; and the family's ratio of income to federal poverty level. We utilized household income and household size to calculate the ratio of family income to federal poverty levels for 2004 and 2007 (DHHS 2007; DHHS 2004). We used midpoints from the categorical variable "annual household income" as the family's income, with families in the highest income category ($200,001 or greater) categorized as having an income of $200,001. School-level characteristics included percentage of minority students in a school as well as binary variables reflecting whether the school was located in an urban (large/mid-size city) or rural (small town) region, with children living in a suburban region as the reference variable.

[REFERENCES]

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